

could be obtained. He completely solved this problem, and believed that this method was destined to prove an indispensable aid to clinical diagnosis. In this we do not think he was mistaken, though the technical difficulties in carrying out the method are considerable.

Dr. Gamgee, as is well known, was a man of the most affectionate disposition, enthusiastic in his work, a good linguist, a fluent speaker, and an excellent classical scholar. The simplicity of his mind and his single-heartedness of purpose endeared him to a wide circle of friends by whom he will be sincerely mourned; for those even nearer and dearer to him, his wife and children, his loss is great and irreparable.

G. A. B.

NOTES.

PROF. H. G. VAN DE SANDE BAKHUYZEN has retired from the directorship of the Leyden Observatory. His place as professor of theoretical astronomy in the University is to be taken by Dr. W. de Sitter, of the Groningen Astronomical Laboratory, whilst Mr. E. F. van de Sande Bakhuyzen is to succeed him as professor of general astronomy and director of the observatory.

PROF. J. BAUSCHINGER has been appointed to succeed Prof. E. Becker as professor of astronomy and director of the university observatory at Strassburg, and Prof. Becker asks that all communications for him should now be addressed to Freiburg i. B., Reichsgrafenstrasse, 17.

WITH regard to the expedition for the exploration of the Charles Louis Mountains in New Guinea, announced in our issue of March 11, we are asked to state, on behalf of the subscribers, that this expedition is being sent out under the auspices of the British Ornithologists' Union in commemoration of its jubilee, held last December, and described in NATURE of December 24 (vol. lxxix., p. 238). It was then decided that this expedition should be known as "The British Ornithologists' Union Jubilee Exploration of the Charles Louis Mountains."

ARRANGEMENTS have been made for a visit by Count Zeppelin in his airship to the International Aëronautical Exhibition to be opened at Frankfort in July next. The airship will be accommodated during the exhibition in one of the large halls now being built in the grounds, and ascents with it will be made.

WE learn from the *Times* that a wonderfully vivid mirage was witnessed from Grimsby on April 8 in the evening. The Humber is six miles wide there, and beyond is three miles of land. This appeared to be lifted high into the air and reversed, the trees inland having the appearance of growing upside down. The Spurn Lighthouse, reversed, was seen four miles from its position, and below the reflection of the land was the North Sea, on which were large steamers, with masts and funnels downwards, passing to and fro.

THE Health Congress, Leeds, 1909, organised by the City and the University of Leeds, with the cooperation of the Royal Sanitary Institute and the Royal Institute of Public Health, will be held on July 17-24. The president is Colonel T. W. Harding, J.P., D.L., and the general secretaries are Dr. Spottiswoode Cameron and Mr. Robert E. Fox, the medical officer of health and town clerk respectively of Leeds. A programme of the preliminary arrangements is published in the Journal of the Royal Sanitary Institute for April (xxx., No. 3).

ONE of the special features of the great Missionary Exhibition, entitled "Africa and the East," which will be

held at the Royal Agricultural Hall from June 8 to July 3, under the auspices of the Church Missionary Society, will be a special exhibit of outfit suitable for missionaries and travellers, which will be shown in a special outfit section. One of the special features of this section will be an exhibition of the various methods of protection from mosquitoes and other insects, which play an important part in the spread of many tropical diseases. The organiser of the section is Dr. C. F. Harford, principal of Livingstone College, Leyton, E.

To encourage enterprise and experiment in British aviation, the *Daily Mail* offers a prize of 1000l. to the aeroplaneist who, within twelve months of April 7, flies a distance of one mile either in a circuit or from a given point to another and returns to the starting point without touching the ground. The other conditions of the award are:—(1) that the motor, planes, propellers, and all other parts be entirely of British manufacture; (2) that the inventor and the aeroplaneist be British subjects, and by British subjects we naturally include those in British colonies; (3) the flight shall take place within the British Isles, and be approved by officials of the recognised aviation organisation. Other prizes offered by the *Daily Mail* are:—10,000l. for a flight by a heavier-than-air machine from London to Manchester with not more than two stops to take in petrol. Offered in November, 1906; and open to aeronauts of all nations. 1000l. for a flight across the Channel by a heavier-than-air machine before the end of 1909. Open to all nations.

DR. WILLIAM JONES, assistant curator of the Field Columbian Museum of Chicago, has been murdered by tribesmen in the Philippines about fifty miles south of Echague. He had gone to the islands in 1906 on a four years' expedition to study the life of the Ilingots. Dr. Jones had Indian blood in his veins, and was born among the Sauk and Fox Indians of Oklahoma about thirty-four years ago. He was educated at the Indian school at Hampton, at Andover Academy, and at Harvard, where he had a distinguished career. He took a post-graduate course at Columbia University, and was then engaged by the Carnegie Institution at Washington on ethnological investigations. His success in unravelling many mysteries of Indian religions led to his appointment at Chicago. According to his chief, Prof. G. A. Dorsey, he was the most promising student of ethnology in America, and a similar opinion has been expressed by the head of the Federal Bureau of Ethnology. The day before the receipt of the cablegram announcing his death, Prof. Dorsey had heard by letter from Dr. Jones of his intention to leave the friendly tribe with whom he had been living in order to pursue his researches in a remote section of the country, which would necessitate his passing through a hostile territory.

THE geological department of the British Museum (Natural History) has received from the National Museum of Natural History, Paris, a plaster cast of the finest skull and mandible of the long-chinned mastodont, *Tetrabelodon angustidens*, from the Middle Miocene of Sansan (Gers), France. The specimen has just been mounted for exhibition with Dr. Andrews's well-known models of the skull and mandible of *Mœritherium* and *Palæomastodon* from the Upper Eocene of the Fayum, Egypt. These three specimens are arranged in series with the American Pleistocene *Mastodon americanus*, so that the principal stages in the evolution of the proboscidean head can now be studied in one view. They show very clearly the lengthening of the symphysis of the lower jaw, which

must have been accompanied by an elongation of the soft face, as the mastodonts increased in size in successive geological periods. In the latest genus, *Mastodon* proper, this elongated soft face, no longer supported by an extension of the lower jaw, must have formed a hanging proboscis, as in the true elephants.

WE regret to announce the death, at the age of sixty-eight years, of Prof. F. E. Hulme, author of several works on botany of a popular character.

THE annual meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers on May 13 and 14, when the following papers may be expected to be submitted:—On the production of iron sheet and tubes in one operation, by S. Cowper-Coles; on the preservation of iron and steel, by A. S. Cushman; on the manufacture of peat fuel, by Dr. M. Ekenberg; on the chemical physics involved in the decarburisation of iron-carbon alloys, by W. H. Hatfield; on the relation of the solubility of iron and steel in sulphuric acid to its heat treatment, by Prof. E. Heyn and O. Bauer; on high-tension steels, by P. Longmuir; on the Bristol recording pyrometer, by P. Longmuir and T. Swinden; on a heat-treatment study of Bessemer steels, by Prof. A. McWilliam and E. J. Barnes; on the Roehling-Rodenhauser electric furnace, by W. Rodenhauser; on the value of physical tests in the selection and testing of protective coatings for iron and steel, by J. Cruickshank Smith; on further experiments on the ageing of mild steel, by C. E. Stromeyer; on a comparison of the methods of determining the hardness of iron and steel, by Prof. T. Turner; on the rusting of iron, and modern methods for its prevention, by Prof. W. H. Walker. A supplement to the report on the determination of carbon and phosphorus in steel, presented by the special committee appointed in 1901, will be submitted by Mr. A. A. Blair. The autumn meeting of the institute will be held in London on September 28, 29, and 30.

ON Tuesday next, April 20, Prof. F. W. Mott, F.R.S., will begin a course of two lectures at the Royal Institution on "The Brain in Relation to Righthandedness and Speech," and on Thursday, April 22, Mr. J. Paterson will deliver a lecture on "How a True Art Instinct may be best Developed," being the first of three lectures on "Aspects of Applied Æsthetics." On Saturday, April 24, Mr. R. T. Günther will begin a course of two lectures on "The Earth Movements of the Italian Coast, and their Effects." The Friday evening discourse on April 23 will be delivered by Mr. Alexander Siemens on "Tantalum and its Industrial Applications," and on April 30 by Dr. Edmund Gosse on "Pitfalls of Biography."

ON April 7 the Guernsey States or legislative assembly rejected a proposal to introduce daylight-saving legislation by a practically unanimous vote. A proposal that Guernsey standard time should be Greenwich mean time was adopted.

A CONFERENCE of members of the Museums' Association and others interested will be held at Towneley Hall, Burnley, on Saturday afternoon, May 15, for the purpose of discussing subjects of interest to those concerned in the work of museums, art galleries, and kindred institutions. Offers of papers or suggestions of suitable subjects for discussion should be sent to the hon. secretary, The Sycamores, Burnley.

A COMMITTEE, consisting of the members of the scientific staff of the Royal Observatory of Belgium at Uccle, is undertaking the preparation and publication of a list of magnetic and seismological observatories, and this list is

to be followed by another dealing with the societies and periodicals particularly concerned with magnetism, seismology, and atmospheric electricity. Such lists will prove of great assistance to physicists occupied with these subjects, since by their aid reference to the researches of other workers will be facilitated greatly. To assist in the work which has been undertaken, the Belgian committee would be glad to receive information from the officials of scientific societies concerned with the physics of the globe. The committee desires to be informed as to the rules of such societies, the date of their foundation, the place of meeting, the subscription, the number of members, the frequency of the meetings, the names of the executive committee, and the publications of the society, and would be greatly assisted by receiving specimen numbers of these. Communications should be addressed to the committee at the observatory.

FOR some time past very alarming reports have been in circulation as to the work on the Panama Canal, and especially as to the stability of the proposed great dam at Gatun. Three years ago it was settled, after an exhaustive inquiry by a commission of engineers, that, taking everything into consideration, and under the special conditions that prevail on the Isthmus of Panama, it was desirable that the canal should have locks in preference to being made throughout at sea-level. There has, however, since that decision was arrived at, been a continuous agitation kept up in the American Press impugning the recommendation of the commission, and alarmist reports have been circulated, especially with reference to the safety of the Gatun dam. About three months ago another commission was appointed by President Roosevelt to inquire into this matter and generally to report as to the works. The main findings of this commission are a full endorsement of the scheme and works as now being carried out, and an expression of confidence in the engineers entrusted with the work. The dimensions of the locks as finally settled are to be 1000 feet in length and 110 feet in width. It is now estimated that the cost of the canal will be seventy-two millions sterling, whereas a sea-level waterway would cost upwards of one hundred millions. It is anticipated that the lock canal will be completed in five years' time, whereas a sea-level canal would take several years longer. From 40,000 to 50,000 men are now employed on the canal. Owing to the very efficient sanitary arrangements that have been carried out, the district has now become fairly healthy, and yellow fever and other diseases common to a tropical swamp, which formerly prevailed, have almost entirely been stamped out.

AMONG the contents of No. 5 of the Bulletin of the Imperial Academy of Sciences of St. Petersburg for 1909 is an article, by Dr. W. Salensky, on the development of the nemertine worm *Prosorochmus viviparus* (= *Monopora vivipara*). As the result of the author's investigations, it appears that the proboscis is in no wise concerned with the formation of the œsophagus; the proboscis and the œsophagus are, in fact, developed independently of one another, and only later come into mutual connection; and, finally, the atrium of the proboscis in *Prosorochmus* (and very probably also in all metanemertines, in which the mouth-opening lies in a so-called rhynchodæum) forms, not only a portion of the proboscis, but also a part of the œsophagus.

THE parasites of the cotton-worm are under investigation in the West Indies, and a report of some of Mr. Jemmett's work thereon appears in a recent issue of the

Agricultural News. The two parasites dealt with are *Chalcis ovata* and a *Spirochalcis*. The latter was found to be parasitic on the *Sarcophagidæ*, which in turn are parasitic on the cotton-worm, but whether they attack healthy or only damaged pupæ is not yet clear.

THE February number of the *Journal of Agriculture of South Australia* contains the results of manurial experiments on wheat made at certain centres in South Australia. Small dressings of superphosphate were found to give remarkable increases in crop, but neither nitrate of soda nor sulphate of potash had much effect. These results are so unusual that it would be interesting to know the composition of the soil and the meteorological data at the various centres.

A PAMPHLET was recently issued by the Midland Publishing Company, Cradock, Cape Colony, on lucerne, in which the characteristics of this valuable crop are set out in detail. The methods of cultivation and of dealing with the pests to which it is liable are described; sections are also devoted to discussing the value of lucerne as food and as green manure. For the South African farmer lucerne has the double advantage of being a leguminous crop, and therefore increasing the amount of nitrogenous organic matter in the soil, and of withstanding drought, because of its deep-rooting habit.

THE rainfall conditions of many districts of the Transvaal are not altogether favourable for vegetation; the fault does not lie so much in the amount of the rainfall as in its irregular distribution. Similar conditions exist in parts of the United States, but have been overcome by special methods of cultivation, and "dry farming" is now extensively practised. The essential part of the scheme is to plough the soil deeply and cultivate the surface frequently, but to keep the subsoil compact; in these circumstances the water is found to remain near the surface, and is not readily dissipated by evaporation. Mr. Macdonald, the official of the Transvaal Agricultural Department who devotes himself to dry farming, has given in the current number of the *Transvaal Agricultural Journal* an interesting account of the various methods adopted and the principles on which they are based.

BULLETIN No. 5 of the Sleeping Sickness Bureau contains a summary of various papers on the development of trypanosomes in, and mode of transmission of trypanosomes by, tsetse-flies, on treatment, on human trypanosomiasis, &c. Now that so much is being written on this subject, it is very useful to have a summary of this kind.

TUBERCULOSIS is the subject of two papers in the March number of the Bulletin of the Johns Hopkins Hospital (xx., No. 216). One, by Dr. Kober, deals with the influence of sewerage and general sanitation on the prevalence of the disease; the other, by Dr. Moss, outlines a plan of study of tuberculosis in all its bearings, and is well worthy of consideration. The place of protozoology in the medical curriculum is also discussed by Dr. Schultz, and the ground such a course should cover is indicated.

THE influence of radium rays on germination and other life processes in plants is discussed by Prof. C. S. Gager in the *Popular Science Monthly* (March). Experiments were made with sealed glass tubes containing radium bromide of different degrees of activity, and with a rod coated with radium bromide. It was found that radium of strong activity or a long exposure produced retardation of growth, or even killed the plants, but emanations of less activity, in certain cases, produced acceleration of growth.

AN article on sand-binding plants is published in the *Indian Forester* (February), in which the author, Mr. V. Subramania Iyer, furnishes an ecological account of the plants growing on the Coromandel coast. The ten species noted as typical sand-binders are *Spinifex squarrosus*, *Cyperus arenarius*, *Ipomoea biloba*, *Canavalia obtusifolia*, *Hydrophylax maritima*, *Spermacece hispida*, *Launaea pinnatifida*, *Pupalia orbiculata*, *Pandanus odoratissimus*, and *Casuarina equisetifolia*. It is mentioned that *Cyperus arenarius* throws out shoots to a distance of 50 feet, and an underground stem of *Ipomoea biloba* measured 40 feet, with internodes averaging 6 inches in length.

THE hardness of oil-palm kernels might well be proverbial, so that the reported discovery on the West Coast of Africa of a variety with soft shells has aroused much interest. Information on the subject, received from various British and foreign colonies along the coast, has been collated in the *Kew Bulletin* (No. 2). The reports confirm the existence of such a variety in the various countries from the Gold Coast to the Cameroons, and point to its being a botanical variety, *microsperma*, of *Elaeis guineensis*. It is doubtful whether this variety comes true to seed, and in this connection experiments are necessary to ascertain whether the plants are generally self-pollinated or if cross-pollination occurs.

THE account of a South African bamboo, contributed by Dr. O. Stapf to the same number of the *Kew Bulletin*, illustrates the difficulty of naming some of these grasses. It has been known for seventy years that a bamboo grows in Cape Colony, but the reference to a genus was uncertain until flowering specimens were collected recently on the Drakensberg above an altitude of 5000 feet, when it proved to be an *Arundinaria*. Mr. J. M. Hillier supplies an article on the lalang grass, *Imperata arundinacea*, distributed through Ceylon and parts of Asia, where it is regarded as a veritable pest. In the search for plants which might provide the material for paper pulp, samples of lalang were submitted to analysis and manufacture. The paper produced was very suitable for a wrapping paper, and was somewhat improved by the addition of cotton.

IN the April number of the *Reliquary* Mr. W. Turner describes a collection of Roman metal-work found at Deep Dale Cave, about three miles from Buxton. The objects seem to have belonged to a party of Roman-Britons who were massacred here by some invading host, possibly Picts or Scots. It is almost certain that the victims met a violent death, because in the talus of the cave hundreds of human teeth were found, but very few interments, indicating that the bodies were devoured by beasts and birds. The objects discovered consist of various fibulæ, one of Celtic origin, with the head of a dragon, or, as some say, of a sea-horse; a lady's toilet appliances hung on a ring; a Celtic penannular brooch; a ring and tweezers—all these articles being of bronze. An iron spear-head was found in a part of the cave near a human interment. The collection, which belongs to Mr. Micah Salt, of Buxton, resembles in many respects the articles found by Prof. Boyd Dawkins at the Victoria Cave, near Settle, and it is believed to be the largest assortment of Romano-British remains found in any single cave in England.

THE Francis Galton Eugenics Laboratory (University College, London) has commenced the issue of a new periodical under the title of the *Treasury of Human Inheritance*, in which will be given collections of pedigrees illustrating the inheritance of various characters in man. In the first double part, which is before us, the pedigrees,

collected from various sources, relate to the transmission of diabetes insipidus, pulmonary tuberculosis, chronic hereditary trophœdema, split foot, polydactylism, brachydactylism, deafmutism, and ability. Each group of pedigrees is accompanied by an introductory memoir by the contributor, giving a brief description of the character itself, illustrated in several cases by very finely executed plates, a verbal description of the individuals referred to in the pedigrees, and a bibliography. The pedigrees themselves, of which there are seventy-four, are given on large plates, special symbols being used to denote individuals possessing or not possessing the character, or showing it only to a modified degree. The *Treasury*, which is published by Messrs. Dulau and Co., promises to be of the highest value, and Prof. Karl Pearson, who acts as general editor, is to be heartily congratulated on his adoption of the scheme. Anyone who has attempted to trace the published pedigrees relating to the transmission of any one character knows how much labour is involved in the search, and the collection of such pedigrees, both new and old, into one publication will render inestimable service to all those who are interested in the study of heredity.

THE summary of the weather for the week ending April 10, just issued by the Meteorological Office, shows the period to have been quite phenomenal for the duration of bright sunshine. The sky was almost cloudless, especially over England and Wales, where the maximum shade temperatures generally exceeded 70° , whilst at night there were sharp radiation frosts. Over the kingdom generally the week was reported as among the brightest ever recorded, the possible duration amounting to 89 per cent. in the east of England, 87 per cent. in the south-east of England, and 82 per cent. in the English Channel. The highest percentage of the possible amount reported from individual stations was 93, at Lowestoft, Yarmouth, Felixstowe, Tunbridge Wells, and Worthing. At Greenwich Observatory the sunshine for the week was 90 per cent. of the possible duration. The thermometer in the sun's rays at Greenwich was 110° or above each day, and on April 9 registered 130° . The week was rainless in most parts of the kingdom.

WE have received a copy of the international balloon observations made by the Bavarian Meteorological Service at Munich in 1908, compiled by Dr. A. Schmauss. They are given in the form of the publications of the Aeronautical Committee, and the separate ascents are generally accompanied by useful remarks and deductions. The results for the year have also been carefully discussed; the following are some of the conclusions arrived at, which agree with those obtained in previous years:—(1) The zone of least variation of temperature is in the region of the upper inversion, while the greatest amplitudes of temperature are recorded at the surface of the earth and at a height of about 8 kilometres; between these places, at about 3 km. above sea-level, a relative minimum is found. (2) The temperature gradient has a maximum variation where, generally speaking, it has the smallest values, viz. at the earth's surface and in the region of the upper inversion, and a minimum in the strata of greatest decrease of temperature, viz. from 3 km. to 9 km. (3) The boundary of the upper inversion is higher in summer than in winter; the lowest temperature occurs, on an average, in summer at 14 km. and in winter at 13 km. (4) The summer temperatures in the inversion are generally 3° C. to 4° C. higher than in winter.

IN the *Atti dei Lincei*, xviii., 4, Prof. P. Pizzetti discusses the theorem according to which the mean value

of a continuous function V of the coordinates over the surface of a sphere of radius R is $(\sinh R\nabla/R\nabla)V_0$, the suffix referring to the centre of the sphere and ∇^2 being Laplace's operator.

THE rôle of thermal analysis in many metallurgical and chemical problems is so important that considerable interest attaches to the report on methods of obtaining cooling curves, by Mr. George K. Burgess (Reprint No. 99, Washington Bureau of Standards). Using a thermocouple and a galvanometer, the method of obtaining photographic records is fairly obvious; for autographic records the friction of the pen is obviated by limiting the tracing to a series of dots. The paper is illustrated by curves representing the relations between temperature and time, differential, rate of change of temperature and reciprocal of the latter, for typical transformations, one being isothermal, another exothermous, and the last endothermous.

A NUMBER of papers have recently appeared dealing with electromagnetic theories, and in particular with the impossibility of explaining electrical and mechanical actions on the hypothesis of a continuous medium. This question forms the subject of a paper, by Dr. Hans Witte, in the *Annalen der Physik*, xxvi., and contributions on pure electromagnetic fields, by Prof. Tullio Levi Civita (*Atti del R. Istituto veneto*, lxvii. [2]) and Leonella Caffaretti, of Rovigo (*Nuovo Cimento*, xv., xvi.). In two contributions to the *Atti dei Lincei*, xviii., 2, 3, Prof. Levi Civita obtains asymptotic expressions for the action of currents and for electric radiations, while the dispersion of energy due to moving charges is described by Dr. Hannibal Comessatti in the *Nuovo Cimento*, xvi.

WE have received the first two numbers of the *Internationale Revue der Gesamten Hydrobiologie und Hydrographie*, a journal specially devoted to the study of oceanography and limnology in all their branches. Prof. Weismann contributes an introductory article, and amongst the authors of original papers are Sir John Murray, Drs. R. Hertwig, Raffaele Issel, A. Nathansohn, Alfred Fischel, C. Klausener, and Gustav Götzinger. An important part of the magazine is a series of reports on recent work and summaries of new publications, by experts. The editor is Dr. R. Woltereck, of Leipzig, and the appearance of the journal, as Sir John Murray justly says, "is a very important event for the future progress of these sciences, and may possibly mark an era in the development of knowledge concerning the Hydrosphere as a whole." We wish our new contemporary every success.

BY the courtesy of Mr. Alfred E. Dean, of 82 Hatton Garden, who is the London agent of Messrs. Jouglé, we have been able to try a sample of the "omnicolore" plate to which we referred on February 4 (vol. lxxix., p. 409). These, like other colour-screen plates, contain in themselves all that is necessary for the photography of objects in "natural colours." The general character of the plate we have already given, and as Lumière's autochrome plates have been in common use for a year or two, it is natural to compare new-comers with them. The procedure recommended by the makers of the omnicolore plate is much simpler than the method of working the autochrome; indeed, it is the simplest possible, considering the general principles involved. The plate, after exposure, is developed, rinsed, placed in an acidified solution of potassium bichromate to dissolve away the silver image, rinsed, returned to the original developer to reduce the silver salt to the metallic state, rinsed, fixed, and washed. Intensification is not necessary, for the sensitive film gives

ample density without it; no clearing baths are necessary, and the original developer works excellently for the second treatment—in all these details the manipulation of the new plate is simpler than what is desirable, if not necessary, in the case of the autochrome. The colours of the omnichrome plate are much more transparent than those of the autochrome, being applied as paints or varnishes instead of being absorbed by translucent starch granules; but this method has its drawbacks as well as its advantages, for the density of the colour is not even all over each little patch of red and green. The colour is lighter towards the margins of the patches, and their shapes, too, are rather irregular, but doubtless improvements will be made in these directions. The plates, as they are, are simple and easy to manipulate, and give results that must be distinctly useful to those who wish to reproduce, or, more correctly, to imitate, by the simplest known method, the colours of the objects they photograph.

OUR ASTRONOMICAL COLUMN.

OBSERVATIONS OF COMET MOREHOUSE.—Comet 1908c was observed, with the 284 mm. Amici equatorial, at Arcetri on forty-one days between September 4 and December 7, 1908, and 127 determinations of its position were made with the micrometer. These are now recorded by Prof. Abetti in No. 4316 of the *Astronomische Nachrichten*, together with a valuable set of notes describing the comet's visual appearance on a number of days.

Mr. Metcalf's note and excellent photographs are also reproduced, from the Harvard Circular No. 148, in the same journal.

A series of six photographs taken at the Dominion Observatory, Ottawa, between October 6 and November 26, is reproduced and described by Mr. Motherwell in No. 1, vol. iii., of the Journal of the Royal Astronomical Society (Canada). The comet was visible at Ottawa for more than three months, but dense smoke and unusual cloudiness prevented an extensive series of photographs from being obtained. Those reproduced show similar knots in, and displacements of, the tail-matter, as previously recorded. On October 20 the head of the comet passed over an eighth-magnitude star without perceptibly dimming it.

Observations of the comet, made with a sextant on board the German steamship *Paranaguá*, are recorded in No. 4317 of the *Astronomische Nachrichten*.

MEASURES OF DOUBLE STARS.—The micrometer measures of double stars made by Dr. Lau and Herr Luplau-Janssen at the Copenhagen Observatory during 1908 are recorded in No. 4315 of the *Astronomische Nachrichten*. The stars observed chiefly lie between declinations 0° and 20° , special attention having also been paid to neglected pairs. In addition to the date, position-angle, and distance, the authors give brief notes concerning the colours of the components, and, where possible, compare the values obtained with those computed from previously published elements.

DIAMETER AND POSITION OF MERCURY.—In these columns on December 24, 1908 (No. 2043, vol. lxxix., p. 232), we noted the corrections to the diameter and position of Mercury, derived by Prof. Stroobant from the observations of the transit of the planet, on November 14, 1907, made at thirty-three observatories. Since the publication of the memoir in which he gave those corrections, Prof. Stroobant has received observed values from eleven additional observers, and has incorporated them in the final results which appear in No. 4317 of the *Astronomische Nachrichten*.

These show, from the time between first and second contact, that the planet's apparent diameter was $9''.166$, whilst the observations of the third and fourth contacts give, similarly, $9''.092$. These values correspond to diameters, at unit distance, of $6''.20$ and $6''.15$ respectively, the latter being probably the more correct.

The corrections to the equatorial and ecliptical coordinates are found to be $\Delta\alpha = +0.070s$, $\Delta\delta = -0''.25$,

and $\Delta\lambda = +1''.03$, $\Delta\beta = +0''.02$, respectively, in the sense observed-calculated.

The agreement of the Italian observations of this passage of Mercury with the data given in various ephemerides is discussed by Signor Pio Emmanuelli in No. 110 of the *Revista di Fisica, Matematica e Scienze Naturali* (Pavia) for February.

THE VATICAN OBSERVATORY.—We learn from the *Times* Milan correspondent that the inauguration of the new section of the Vatican Observatory, which was to have taken place on March 18, was postponed because one of the components of the 40-cm. object-glass for the new equatorial refractor was found to be defective, and has to be re-cast.

When this new section is complete the Gregorian Specola will be abandoned, and the whole of the observatory will be located on the summit of the Vatican hill, 100 metres above the square of St. Peter's, where Father Lais has been engaged, since 1891, in taking the photographs for the International Astrographic Chart (the *Times*, Engineering Supplement, April 7).

PRODUCER GAS FOR ENGINES.

I.—PROCESSES AND PLANTS.

IT is well known that what is technically called 'producer gas' has been in use for many years in connection with furnace work. Herr Bischof, of Magdesprung, was the first to use an internally fired gas producer for this purpose in 1839; but little progress was made in our country until 1857, when the late Sir William Siemens introduced the combined gas producer and regenerative furnace with which his name is associated. Some twenty years later it occurred to me that a gas engine might be worked with producer gas if a suitable plant were devised. For furnace work the hot gas is taken direct from the producer to the furnace without cooling or cleaning, and the condensable hydrocarbon vapours, which usually accompany the gas, and add appreciably to its value, are burnt. But for engine work it is essential to wash and clean the gas, especially as it must be free from tar. It is also desirable that the gas should be cool when it enters the cylinder of the engine. Incidentally, this involves the removal by condensation, &c., of the condensable hydrocarbons which leave the producer, and after their removal the gas must still be strong enough to fire well and give good working results in the engine. I succeeded in making a suitable plant, and it was first tried with a small Otto engine in 1879; the results were good, and they encouraged the makers of the engines to build them of larger size so as to compete favourably with steam-power. Many thousands of horse-power are now working with gas plants of this type, and during the last few years a still further impetus has been given to the subject by the use of a modified plant, which is known among engineers as a *suction plant*, and which will be more fully described later.

For the moment we will consider briefly the process of making producer gas, and some of the chemical reactions involved. Producer gas is made by forcing or drawing air, with or without the addition of steam or water vapour, through a deep bed of incandescent fuel in a closed producer. Usually the fuel is fed in at the top, and the currents of air, or of steam and air, enter at the bottom, the gas outlet being near the top. An important characteristic of the process is that no external heat is applied to the producer, as in the case of an ordinary gas retort. When once the burning of the fuel *inside* the producer has been started, the air which is used to make the gas keeps up a continuous process of combustion, and a sufficiently high temperature is maintained to decompose the steam and to effect other necessary reactions.

We know that if there were a shallow fire of carbonaceous fuel and a sufficient supply of air, the carbon would be completely oxidised. The product of this complete combustion would be carbon dioxide, with the development of a large amount of sensible heat; but if there were a considerable depth of carbon in the producer (as there should always be in practice) the resulting gas would be carbon